5-2017

Flux Focusing Axial Magnetic Gear

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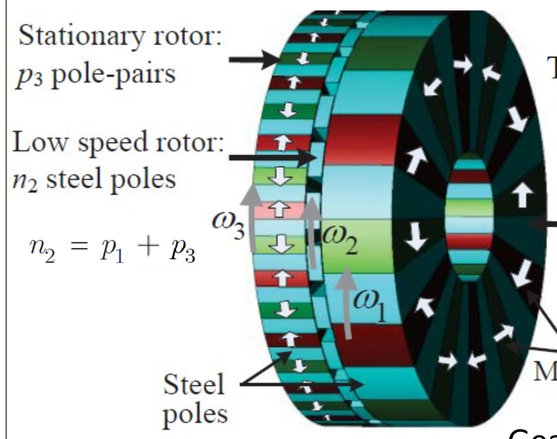
"The authors acknowledge the support of the Semiconductor Research Corporation (SRC) Education Alliance (award # 2009-UR-2032G) and of the Maseeh College of Engineering and Computer Science (MCECS) through the Undergraduate Research and Mentoring Program (URMP)"

Introduction

Gear reduction and power transmission is achieved through a mechanical gear. These gears require maintenance, cause vibration, and have no overload protection. Magnetic gears (MGs) are innovative solution to these drawbacks. The flux focusing axial magnetic gear (FFAMG) was assembled for future testing of power transmission applications.

Concept and Design



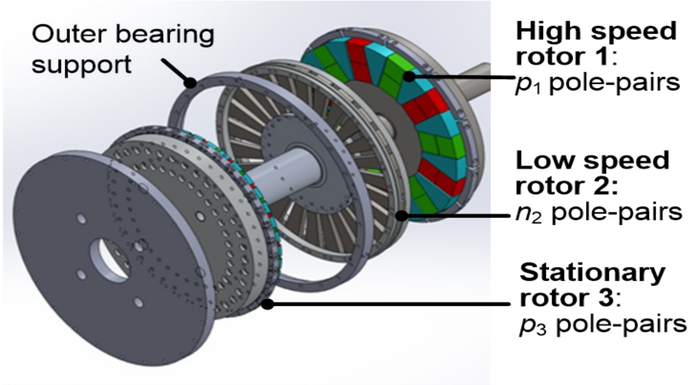
Torque

$$T_1 + T_2 + T_3 = 0$$

Gear Ratio

$$\omega_1 = \left(\frac{n_2}{n_2 - p_3}\right)\omega_2 = G\omega_2$$

Angular Velocity



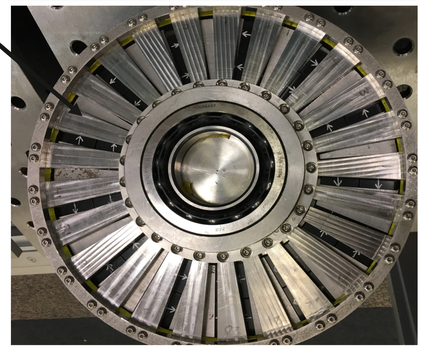
Theory of the Magnetic Gear (MG)

Mechanical gears are used to transmit power by converting low speed, high torque rotary motion into high speed, low torque rotary motion, or vice versa, through a gear ratio. The innovative FFAMG uses a ratio of magnetic poles to accomplish the same power transmission.

Mechanical Assembly

n_2 = 25 steel poles

Low Speed Rotor



p_1 = 6 pole pairs

High Speed Rotor

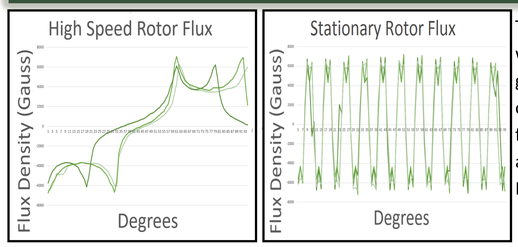
p_3 = 19 pole pairs

Stationary Rotor

Resulting Pole Ratio

$$\omega_1 = \left(\frac{25}{25-19}\right)\omega_2 = 4.16\omega_2$$

Measured Data



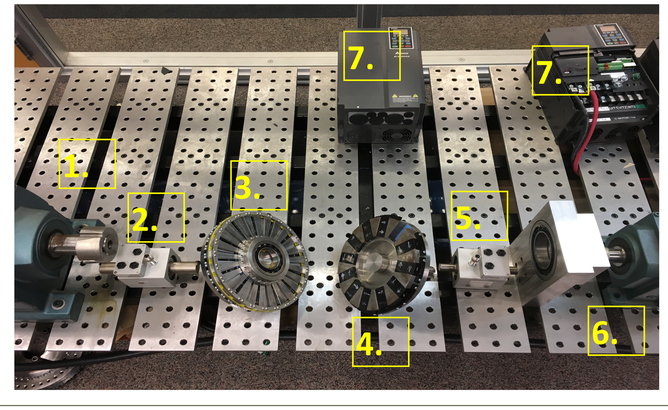
The magnetic flux density was measured with a gauss meter as a function of degrees around the face of both the stationary and high speed rotor. Peaks at 6000 Gauss

Conclusion

The FFAMG was assembled successfully, magnetic flux density measurements were gathered and procedures for testing and continuing research developed.

Future Testing Setup

1. Prime Mover
2. Torque Transducer
3. Low Speed Rotor
4. High Speed Rotor
5. Torque Transducer
6. Load
7. Variable Freq Drive



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